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ROADSIDE SEED MIX

PLANT SPECIES RECOMMENDATIONS FOR ILLINOIS TOLL HIGHWAY ROADSIDES

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EXECUTIVE SUMMARY

▷ Analyzed seed and plug mixes used along roadsides to
- Maximize ecological value
- Reduce seed costs

▷ Desirable plants:
- Are adapted to local conditions
- Stabilize soils
- Provide habitat for native wildlife
- Increase pollinator communities
- Provide nectar and food throughout growing season

INTRODUCTION

In summer 2020, I was asked to advise the Illinois State Toll Highway Authority (ISTHA) on improving seed and plug mixes for native roadside plantings. The goal was to create species lists that maximize ecological value with reduced seed costs for restoration and native plantings.

Besides being adapted to local conditions and holding soil in place with their extensive root systems, native plant species provide wildlife habitat. Roadside plantings can provide important resources for pollinator species, many of which are in peril due to habitat loss and other anthropogenic factors (Goulson et al., 2015). Mixes must include species that grow and bloom throughout the growing season to provide nectar and larval food sources for pollinators (USDA, NRCS, 2014). Restoration to achieve this goal, however, can be costly, so economic factors should also be considered.

MATERIALS AND METHODS

To refine the existing ISTHA species lists, I first drew on knowledge from myself and other native plant propagation and restoration experts. Next, I considered the potential benefits to declining pollinator species by consulting published materials on the floral resources they use. Finally, because not all species may be readily available, I consulted native plant and seed nurseries for species availability and pricing. The nurseries examined include Cardno Native Plant Nursery, Genesis Nursery, Pizzo Native Plant Nursery, Possibility Place Nursery, and Taylor Creek Restoration Nurseries.

RESULTS AND DISCUSSION

Maximizing ecological value

Species should be chosen to bloom across as much of the growing season as possible, but commercially available options for forbs blooming early are limited. ISTHA pollinator mix 4G (Table 1) contains Cream Indigo (*Baptisia leucophaea*), which begins blooming in early May (Wilhelm and Rericha, 2017), but most other species on the list bloom in mid to late summer. I recommend adding Golden Alexanders (*Zizia aurea*) as an early-season bloomer. Golden Alexanders are readily available from nurseries and begin blooming in the Chicago area as early as mid-April (Wilhelm and Rericha, 2017). This plant is already included in ISTHA's bioswale species list as a wetland species (Table 2), but it is adaptable to a range of soil moisture conditions. An additional native forb species blooming early and providing good pollinator resources is Shooting Star (*Dodecatheon meadia*). Although Shooting Star is an expensive species with limited availability from nurseries ($217.50 per ounce from Taylor Creek), it would provide nectar for pollinators beginning in early April. Another advantage of Shooting Star is its ephemeral nature. It blooms and goes

dormant before more aggressive and taller species can overtake it. Shooting Star can take many years to establish when seeded directly (D. Gardner, pers. comm., January 26, 2021), so buying or growing plugs might be preferable and more cost-effective. At sites where woody species are appropriate, spring-blooming native trees and shrubs such as American Plum (*Prunus americana*) or Serviceberry (*Amelanchier species*) could be planted for early-season nectar resources.

Trifolium species such as White and Alsike Clover are an affordable and easily established alternative to early-blooming natives for providing nectar resources (USDA, NRCS, 2014; Seitz et al., 2020; MacIvor et al., 2014). Burt et al. (2020) found that while a lawn mixture of 4 grass species supported a network of 16 pollinator species in western N.Y., a roadside mix containing 3 grass species and White Clover supported 77 species. Although *Trifolium* species are not native, they are unlikely to outcompete robust native species in the long-term and are currently being approved in some NRCS pollinator mixes in Illinois (W. Handel, pers. comm., January 25, 2021. Red Clover (*Trifolium pratense*) is also a possible addition benefitting pollinators but might be more likely to suppress planted native species (F. Hassler, pers. comm., February 1, 2021). *Trifolium* species also appear at most sites as early-successional volunteers.

Asters (*Symphyotrychum, Eurybia,* and *Doellingeria sp.*) and goldenrods (*Solidago, Oligoneuron,* and *Euthamia sp.*) comprise most of the late-season nectar resources in full-sun prairie communities. These genera are currently

Table 1. Species in current ISTHA planting mixes 4E, 4F, and 4G, excluding cover crops and non-native turf grass.

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Species	Common Name	Comments
Asclepias syriaca	Common Milkweed	
Asclepias tuberosa	Butterflyweed	Suggest remove/replace
Baptisia leucophaea	Cream Indigo	
Bouteloua curtipendula	Side Oats Gramma	
Castilleja coccinea	Indian Paintbrush	Suggest remove/replace
Chamaecrista fasciculata	Partridge Pea	
Coreopsis palmata	Prairie Coreopsis	
Dalea candida	White Prairie Clover	
Echinacea pallida	Pale Purple Coneflower	
Elymus canadensis	Canada Wild Rye	
Liatris cylindracea	Dwarf Blazing Star	Suggest remove/replace
Liatris pycnostachya	Prairie Blazing Star	Susceptible to loss from voles
Lupinus perennis	Lupine	Suggest remove/replace
Monarda citriodora	Lemon Mint	Suggest replace with *M. fistulosa*
Oligoneuron riddellii	Riddell's Goldenrod	Suggest remove/replace
Panicum virgatum	Switch Grass	
Penstemon digitalis	Foxglove Beardtongue	
Penstemon grandiflorus	Large-Flowered Beardtongue	Suggest remove/replace
Pycnanthemum virginianum	Common Mountain Mint	
Rudbeckia hirta	Black-eyed Susan	Biennial
Schizachyrium scoparium	Little Bluestem	
Solidago speciosa	Showy Goldenrod	
Sorghastrum nutans	Indian Grass	
Sporobolus heterolepis	Prairie Dropseed	Lower success rate vs. other bunchgrasses
Symphyotrichum ericoides	Heath Aster	
Symphyotrichum laeve	Smooth Blue Aster	
Tradescantia ohiensis	Ohio Spiderwort	
Verbena stricta	Hoary Vervain	
Vernonia fasciculata	Common Ironweed	
Veronicastrum virginicum	Culver's Root	

represented by 3 species (1 goldenrod and 2 asters) in mix 4G and 2 species in wetland seed and plug mixes. Also included in mix 4G is Common Mountain Mint (*Pycnanthemum virginianum*), an excellent nectar source that blooms from June through October and quickly establishes in plantings. New England Aster (*Symphyotrychum novae-angliae*) should be added to mix 4G, as it is commonly available and establishes well from seed on roadsides (Busby, 2014) and in restorations (Drobney et al., 2020). Other asters and goldenrods for both upland and wetland sites are suggested in Table 3.

Pollinators also require resources for nesting and overwintering, including stems of flowering plants and native bunchgrasses. Native bunchgrasses also provide forage for some butterfly species (USDA, NRCS, 2014). The NRCS recommends seeding up to 25% bunchgrasses in pollinator plantings (USDA, NRCS, 2011). Meissen et al. (2020) suggest a higher grass percentage, 1:1 grass to forbs, can provide multifunctional ecological and practical benefits. While gathering data along ISTHA roadsides for Pollinator Scorecard development (Sivicek and Jarvis, 2021), I observed well-established planted native bunchgrasses, including Big Bluestem (*Andropogon gerardii*), Little Bluestem (*Schizachyrium scoparium*), Indian Grass (*Sorghastrum nutans*), and Side Oats Grama (*Bouteloua curtipendula*), particularly in the I-90 corridor.

Using locally appropriate species

Existing ISTHA mix 4G (Table 1) includes North American native species generally recommended by

Table 2. Species in ISTHA wetland/swale seed and plug mixes, compiled from provided planting lists and monitoring reports, excluding cover crops and non-native turf grasses.

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Species	Common Name	Comments
Acorus calamus	Eurasian Sweet Flag	Replace with *A. americanus* if possible
Alisma subcordatum	Common Water Plantain	
Asclepias incarnata	Swamp Milkweed	
Calamagrostis canadensis	Blue Joint Grass	
Carex comosa	Bristly Sedge	
Carex lacustris	Common Lake Sedge	
Carex pellita	Prairie Wooly Sedge	
Carex stricta	Common Tussock Sedge	
Chasmantheum latifolium	Northern Sea Oats	
Eleocharis obtusa	Blunt Spikerush	
Hibiscus laevis	Halberd-Leaved Rose Mallow	
Iris shrevei	Blue Flag Iris	
Juncus effusus	Soft Rush	
Juncus interior	Inland Rush	
Juncus tenuis	Path Rush	
Juncus torreyi	Torrey's Rush	
Liatris spicata	Marsh Blazing Star	Susceptible to loss from voles
Pedicularis lanceolata	Marsh Betony	
Schoenoplectus tabernaemontani	Great Bulrush	
Scirpus cyperinus	Woolgrass	
Bolboschoenus fluviatilis	River Bulrush	
Sparganium euycarpum	Common Bur Reed	
Spartina pectinata	Prairie Cord Grass	
Symphiotrychum lanceolatum	Panicled Aster	
Symphiotrychum puniceum	Swamp Aster	
Verbena hastata	Blue Vervain	
Zizia aurea	Golden Alexanders	

the Xerces Society for Invertebrate Conservation as pollinator resources. However, several species are either not native to the Chicago Region or are known from only specialized habitat types. Species found west of Illinois and not native to the region include Large-Flowered Beard Tongue (*Penstemon grandiflorus*) and Lemon Mint (*Monarda citriodora*) (USDA, NRCS, 2021). The species found on specialized habitat types include Lupine (*Lupinus perennis*) – found on sandy soils – and Cylindrical Blazing Star (*Liatris cylindracea*) – found on well-drained, coarse-textured calcareous sites, such as gravel hill prairies (Wilhelm and Rericha, 2017). Additionally, Riddell's Goldenrod (*Solidago riddellii*) and Indian Paintbrush (*Castilleja coccinea*) are typically limited to high-quality gravelly calcareous sites with a groundwater source (Wilhelm and Rericha, 2017).

Six species from mix 4G are suggested to be removed (Table 1), and 35 species are recommended as substitutions or additions (Table 3). As an additional resource, an appropriate regional list of pollinator-friendly species for the Midwest Region, including Illinois, Indiana, Iowa, and Missouri, can be found in a Xerces Society publication, Pollinator Plants: Midwest Region (Xerces Society for Invertebrate Conservation, 2017). All the species on this list are native to the Chicago area. Mix 4G currently contains 7 of these species and 4 close relatives of species on the list.

Wetland and swale planting lists (Table 2) contain appropriate species, but additional species are suggested that can be added or substituted (Table 3). Swamp Milkweed (*Asclepias incarnata*) is the only Monarch larval host species readily available from nurseries likely to establish in wet roadside sites. I have observed the species established and doing well in moist to wet sites along ISTHA roadsides and throughout the state.

Reducing costs

To keep plantings costs down, I suggest removing species difficult to establish in roadside sites, some of which are also among the most expensive on ISTHA's current lists. These include the conservative species with narrow and specific habitat needs mentioned above and low success rates in plantings.

A study sampling 17 IDOT roadside sites across the northern third of Illinois 3–5 years after establishment (Busby, 2014) found the most frequently observed planted forbs were Yellow Coneflower (*Ratibida pinnata*) and False Sunflower (*Heliopsis helianthoides*). Additionally, New England Aster (*Symphyotrychum novae-angliae*), Wild Bergamont (*Monarda fistulosa*), Prairie Dock (*Silphium terebinthinaceum*), and Compass Plant (*Silphium lacinatum*) were frequently observed. The author only observed 15 seeded upland forb species across all sites, out of approximately 30 forb species planted.

Visiting a recently established ISTHA roadside site along I-355 in fall 2020 (Plate 1), I observed only 4 of the 24 planted 4G mix forb species: Common Milkweed (*Asclepias syriaca*), Wild Bergamot (*Monarda fistulosa*, which had been substituted in the mix for *Monarda citriodora*), Common Mountain Mint (*Pycnanthemum virginianum*), and Black-eyed Susan (*Rudbeckia hirta*). Yellow Coneflower was also present, possibly as an unintentional inclusion in the seed mix. Although some species might appear at the site next year or the year after, this observation did not suggest a high degree of success for the mix. The 5 species above are, however, important species for Monarch larvae, providing nectar resources from mid-summer into fall.

Many species in mix 4G were among those seeded along IDOT roadsides but not found by Busby (2014). These include Butterfly Milkweed (*Asclepias tuberosa*), Smooth Blue Aster (*Symphyotrychum laeve*), Prairie Blazing Star (*Liatris pycnostachya*), White Prairie Clover (*Dalea candida*), Ohio Spiderwort (*Tradescantia ohiensis*), and Culver's Root (*Veronicastrum virginicum*). Additionally, Busby (2014) rarely encountered Prairie Dropseed (*Sporobolus heterolepis*). This conservative native bunchgrass species might be more difficult to establish than the others on ISTHA lists, given its failure at other restored sites (Drobney et al., 2020).

Busby (2014) suggested vole predation on corms as a likely reason for Prairie Blazing Star establishment failure, and recommended the removal of *Liatris* species from IDOT planting lists for this reason. Liatris species provide excellent nectar resources and food for the animals that consume the corms, but possible loss at some sites where voles are present should be taken into consideration.

Milkweed species (*Asclepias sp.*) are essential in roadside pollinator seed mixes due to Monarch Butterfly larval host plant specificity. I recommend using common milkweed species that spread readily and tolerate disturbance. These include Common Milkweed (*Asclepias syriaca*), Whorled Milkweed (*Asclepias verticillata*), and, in wet sites, Swamp Milkweed (*Asclepias incarnata*). I have observed these 3 species established in ISTHA roadside plantings (Sivicek and Jarvis, 2021). I suggest removing Butterfly Milkweed (*Asclepias tuberosa*) from the list because the species can

Table 3. Species suggested as substitutions or additions, with height, bloom time, and growing location information.

Species	Common Name	Bloom Time	Height (m)	Upland/ Wetland	Comments
Andropogon gerardii	Big Bluestem	July–Sep	2	Upland	Bunchgrass
Baptisia lactea	Wild White Indigo	May–Aug	1.5	Upland	
Bidens cernua	Nodding Bur Marigold	June–Oct	0.8	Wetland	
Carex grayii	Common Bur Sedge	May–June	0.8	Wetland	
Carex vulpinoidea	Brown Fox Sedge	May–June	0.9	Wetland	
Cynanchum laeve/Ampelamus laevis	Blue Vine	June–Sep	climbing	Upland	Low current availability but beneficial to monarch larvae
Desmathus illinoensis	Illinois Bundleflower	July–Aug	1	Upland	
Desmodium canadense	Showy Tick Trefoil	June–Sep	1	Upland	
Dodecatheon meadia	Shooting Star	April–June	0.3	Upland	Ephemeral
Eryngium yuccafolium	Rattlesnake Master	July–Sep	1.5	Upland	
Eupatorium altissimum	Tall Boneset	Aug–Oct	2	Upland	
Eupatorium/Eutrochium maculatum	Spotted Joe Pye Weed	June–Oct	2	Wetland	
Eupatorium perfoliatum	Common Boneset	July–Oct	1	Wetland	
Eupatorium serotinum	Late Boneset	July–Oct	1	Wetland	
Euthamia graminifolia	Grass-leaved Goldenrod	July–Sep	1.2	Wetland	
Glyceria striata	Fowl Manna Grass	May–July	1.5	Wetland	
Helenium autumnale	Sneezeweed	July–Nove	1.2	Wetland	
Heliopsis helianthoides	False Sunflower	June–Oct	1.2	Upland	
Lythrum alatum	Winged Loosestrife	June–Sep	1	Wetland	
Monarda fistulosa	Wild Bergamot	June–Oct	1.2	Upland	
Pedicularis canadensis	Wood Betony	April–June	0.2	Upland	Hemi-parasite on grasses
Pycnanthemum tenuifolium	Slender Mountain Mint	June–Aug	1	Both	
Ratibida pinnata	Yellow Coneflower	July–Oct	1.2	Upland	
Rudbeckia subtomentosa	Sweet Black-Eyed Susan	July–Sep	2	Both	
Silphium integrifolium	Rosinweed	June–Sep	1.5	Upland	
Silphium laciniatum	Compass Plant	June–Sep	3	Upland	
Silphium terebinthinaceum	Prairie Dock	June–Sep	2	Upland	
Solidago rigida/Oligoneuron rigidum	Stiff Goldenrod	July–Oct	1.2	Upland	
Symphyotrichum novae-angliae	New England Aster	July–Oct	1.2	Upland	
Symphyotrichum oolentangiense	Sky Blue Aster	July–Nov	1	Upland	
Symphyotrichum prealtum	Willow Aster	July–Oct	1	Wetland	
Tridens flavus	Purpletop	Aug–Sep	1.2	Upland	Bunchgrass
Verbena urticifolia	White Vervain	July–Sept	1.5	Both	
Vernonia missurica	Missouri Ironweed	July–Sep	2	Both	
Zizea aurea	Golden Alexanders	April–June	1	Both	

be difficult to establish, intolerant of disturbance and less than ideal site conditions, and short-lived.

At the I-355 site, other roadsides, and statewide, I have observed common native species such as Hairy Aster (*Symphyotrychum pilosum*), Panicled Aster (*Symphyotrychum lanceolatum*), Common Evening Primrose (*Oenothera biennis*), and Late Boneset (*Eupatorium serotinum*) established as volunteers. These species should be encouraged, as they add value to the site at no cost. Late Boneset, in particular, is an excellent late-season nectar source. I have observed this species covered in various butterfly and bee species while in bloom, and the NRCS lists it as "very high" value to Monarch Butterflies (USDA, NRCS, 2016). Although it will likely appear on its own at many sites, this species could also be lightly seeded to give it a head start. However, it is not commonly commercially available. I found only 1 nursery offering Late Boneset seed: Taylor Creek, at $43.50 per ounce according to their price list at the time of this writing.

Plate 1. ISTHA management area #55 along I-355, a recently established pollinator planting of woody and herbaceous species.

Common native goldenrods, such as Canada Goldenrod (*Solidago canadensis*) and sunflowers, such as Sawtooth Sunflower (*Helianthus grosseserratus*), also often appear as volunteers on the roadside and provide late-season nectar. Common native shrubs colonizing roadside sites, such as Elderberry (*Sambucus canadensis*), blackberries (*Rubus sp.*), sumacs (*Rhus sp.*), and roses (*Rosa sp.*) provide hollow, pithy stems for stem-nesting bees.

Additional suggestions

If it is available, I suggest ISTHA consider planting Blue Vine (*Cyanchum laeve*) along right-of- way fences. The species, a member of the milkweed family, is used by Monarch larvae as a host plant (Yeargan and Allard, 2005). It is uncommon in the Chicago Region but is known from Will, Kendall, and DeKalb counties (USDA, NRCS, 2021) and several surrounding counties to the south and west. It is adaptable to a wide range of soil and moisture conditions. Blue Vine is not readily available from nurseries at the time of this writing, but this is more likely due to lack of demand rather than the species' difficulty to obtain or rarity. Possibility Place Nursery has grown Blue Vine once in the past, and although they do not regularly offer it, they would consider growing plugs as part of a larger contract if a seed source is available (K. Shaw, pers. comm., February 3, 2021). I suggest contacting nurseries and growers again in the future to reevaluate availability. Once established, Blue Vine is long-lived and will spread via deep rhizomes and seed.

The ISTHA 4G pollinator mix includes Indian Paintbrush (*Castilleja coccinea*), a species partially parasitic on the roots of other plants. Indian Paintbrush has some desirable qualities, including pollinator value and its capacity to reduce the height of plants it parasitizes. However, as mentioned above, it is rarely available from nurseries, expensive, and unlikely to succeed in roadside sites given it is conservative and specificity to calcareous sites such as hill prairies and fens (Wilhelm and Rericha, 2017). If a hemiparasite is desired, I suggest Wood Betony (*Pedicularis canadensis*) if it is available. Wood Betony has broader habitat requirements, as it is found throughout the state in various prairie and open woodland habitats. It blooms early in the season (April through June), providing nectar for various bee species

(Wilhelm and Rericha, 2017). Wood Betony parasitizes the roots of grasses and sedges and can be established by sowing it into sites with existing grass species with light discing to damage roots (D. Gardner, pers. comm., January 26, 2021) that seed at the same time as grass seed. Cardno and Pizzo carry this species; additionally, Prairie Moon Nursery in Winona, MN, has seed available at $50 per ounce retail and uses it in some large seed mixes.

The ISTHA's planting list contains non-native salt-tolerant turf grasses appropriate for the immediate roadside. Native species, most of which are salt intolerant (USDA, NRCS, 2021), should be planted further from the road. Height is also an important factor when considering the placement of species in seed mixes along the roadway. I suggest 2 *Silphium* species, Compass Plant (*Silphium laciniatum*) and Prairie Dock (*Silphium terebinthinaceum*), be added to the native forb list for backslopes. As tall, showy, disturbance-tolerant species, they provide pollinator resources throughout the summer and establish from seeding along roadways (Busby, 2014).

CONCLUSION

Although high species richness is desirable for habitat quality and supporting a diverse assemblage of arthropods, including pollinators (Kelleher and Choi, 2020), I suggest limiting seeded species to those known to establish in northern Illinois roadsides. I also recommend gathering monitoring data at all planted sites within a few years of planting to measure the species' success rates and use the information to refine lists and management practices further. If a previously untested species is added to a mix, I suggest experimentally adding it to a few sites and monitoring progress.

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